THOUGHTS ON THE NATIONAL SCIENCE FOUNDATION (NSF)

The last few years have seen increasing attention to the question of whether U.S. science is contributing at optimal efficiency to the achievement of national goals including societal problems, and economic development. There are two parts to this question. One is the vitality and excellence of the fundamental scientific research that is the ultimate source of new technologies and the second is the mechanism(s) by which new knowledge, generated by the research, is developed and applied as technology.

Because of the philosophy and mechanisms that have supported the fundamental research enterprise in the U.S. since World War II, embodied in the NSF (and also the NIH), our nation has a community of scientists and a scientific enterprise that are the envy of the world. Our emphasis on investigator initiated research, and the coupling of training and research have been enormously successful. Peer review, with all its faults, is the best way known to optimize the probability that truly meritorious projects are identified and supported. There is strong independent evidence for our success; advanced students from around the world seek training in American institutions, and Europe, west and east, is copying our system.

Much as we might wish it to be otherwise, science is opportunistic; scientists investigate what current knowledge and tools make possible. Thus, the reason why the questions being investigated through basic research may differ from those that policy makers may want to see answered is that the scientists investigate questions that **can** be answered; to set questions on the basis of what we would **like** to know, can involve us in a lot of expensive wishful thinking. If policy is set only by those whose job is to define societal problems and national goals but who lack intimate appreciation for the "possible" we will wind up wasting talent and money.

Basic research is for the future. Achieving present societal goals, including economic development, demands application of the best of already existing knowledge. Japan is often held up as a country that has been successful in linking national goals and scientific knowledge. But it is essential to recognize that their

success is based on linking **our** research with **Japan's** national goals. This suggests that our 'linkage' mechanisms may need overhauling, but not our basic research enterprise.

Thus, the original goals of the NSF should be reaffirmed. Among these was the responsibility for training young scientists. Early in NSF history, this meant supporting predoctoral and postdoctoral education. Later, NSF educational efforts came to include primary and secondary school science education. Just as cutting-edge research by faculty is essential to effective science teaching in colleges and universities, so involvement of scientists is critical to excellence in K-12 science education. Therefore, besides the continued support of original, investigator initiated research, NSF should enhance its science education efforts at every level.

The NSF's mission should not be diluted and weakened by mixing it with "technology transfer", which involves very different goals, philosophies, mechanisms, and communities. Industrialists and scientists alike recognize that the private sector will never support basic research. They also realize that without such research, the advancement of technology and industrial innovation will dry up for lack of truly innovative ideas. The government must therefore continue its support of basic research. At the same time, it must foster technology transfer, which is essential and different enough to have its own agency and approach. Nevertheless, it is important that the NSF (and the NIH) promote and facilitate scientists' interests in participating, with industry, in "technology transfer". Incentives should be maintained and even enhanced; disincentives should be removed. This will require careful attention to what are termed "conflicts-of-interest" arising from participation of federally funded scientists with industry.

The new administration has plenty of difficult challenges; it shouldn't waste its energies by fiddling with the NSF, a remarkably successful federal enterprise.

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